

**Redescription of *Sudanonautes faradjensis* (Rathbun, 1921),
a fresh-water crab from Central Africa
(Brachyura: Potamoidea: Potamonautidae)**

Neil Cumberlidge

Department of Biology, Northern Michigan University, Marquette, Michigan 49855, U.S.A.

Abstract.—The fresh-water crab *Sudanonautes faradjensis* (Rathbun, 1921), previously considered to be a subspecies of *S. africanus* (A. Milne Edwards, 1869), is recognized here as a valid species. The species is redescribed from the holotype and from a large series of specimens from four countries in Central Africa. *Sudanonautes faradjensis* is identified by a combination of characters of the carapace, chelipeds, and gonopod 1. The distribution of *S. faradjensis* includes the northern part of the rain forest region of Central Africa, from south Cameroon to Zaire.

The Central African fresh-water crab *Sudanonautes faradjensis* (Rathbun, 1921) was first described from material collected by the American Museum of Natural History Congo expedition of 1911–1915, led by H. Lang and R. Chapin. Although *S. faradjensis* was subsequently recognized as a valid species by a number of authors (Balss 1929, 1936; Chace 1942; Capart 1954), more recently others (Bott 1955, Monod 1977) have considered this taxon to be a synonym of *S. (S.) africanus chaperi* (A. Milne Edwards, 1887). The latter taxon was redescribed by Cumberlidge (1985), who assigned it to the genus *Liberonautes*, and also indicated that *Potamon (Potamonautes) faradjensis* Rathbun, 1921 was most likely a valid species. Based on the examination of the types of both *L. chaperi* and *S. faradjensis* the two species have indeed been found not only to be distinct, but also to belong to different genera. Rathbun's (1921) original description did not include adequate descriptions of gonopods 1 and 2, and of a number of other characters which are now thought to be necessary for the proper identification of the species in this genus, and so the species has been redescribed here from the holotype from Faradje, Zaire.

Materials and Methods

The left mandible and left gonopods 1 and 2 were illustrated following removal from the specimen (Fig. 2a–g). Carapace length (CL), carapace width (CW), carapace height (CH), and front width (FW), were recorded from each specimen using digital calipers. Carapace proportions were calculated according to carapace length, and the resulting data pooled and used for descriptions of growth (Fig. 3a, b). Statistical comparisons between species were made between sexually mature adults only. Since many literature records are not reliable, the distribution of *S. faradjensis* described here is based on data from the direct examination of specimens from 20 different localities in four countries.

The following abbreviations are used: AMNH, American Museum of Natural History, New York; MNHN, Muséum National d'Histoire Naturelle, Paris; NHM, The Natural History Museum, London, UK; NNH, National Natuurhistorisch Museum, Leiden, The Netherlands; NMU, Northern Michigan University, Marquette; RCM, Royal Congo Museum, Tervuren, Belgium; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC; ZMB,

Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; CW = carapace width at widest point; CL = carapace length, measured along median line; CH = cephalothorax height, maximum height of cephalothorax; FW = front width, width of front measured along anterior margin, M = male, F = female, juv = juvenile.

Family Potamonautidae Bott, 1970

Sudanonautes faradjensis

(Rathbun, 1921)

Figs. 1–3

Potamon (Acanthothelphusa) faradjensis Rathbun, 1921:428–430, pl. 31, fig. 13 (type locality: Faradje, Zaire).

Potamon (Potamonantes) faradjensis.—Balss, 1929:126, fig. 8; 1936:166–7, fig. 1.

Potamon faradjensis.—Chace, 1942:211.—Capart, 1954:833, figs. 8, 20.

Sudanonautes (Sudanonautes) africanus chaperi.—Bott, 1955:298–299 (part), pl. XXVII, figs. 1a–c, 2, 62, 96a, b.—Monod, 1977:1216 (part). Not *Parathelphusa chaperi* A. Milne Edwards, 1887.

Types.—AMNH 3346, Holotype, Faradje, Zaire, adult M (CW 71.5, CL 51.0), Dec 1912, coll. H. Lang & R. Chapin. AMNH 3351, paratypes, Faradje, 1 M, 2 F, coll. H. Lang & R. Chapin (photographed and illustrated by Rathbun, 1921). RCM 836, paratype, van Kerkhovensville, coll. Apr 1912, H. Lang & R. Chapin, AMNH.

Material examined.—Cameroon: NHM 25.1.1937/8, Papita section, dense forest country, Lomie District, 1 M, 2 F, coll. 1936, Mr. Merfield (from Powell-Cotton Museum). RCM 53.283, Dokwa, 1 M, 3 Jul 1970, coll. Thijs van den Audenaerde. RCM 54.171, Dja Posten, River Dja, 1 M, CW 75.9 mm, 8 Mar 1975, coll. Thijs van den Audenaerde. RCM 54.197, Meri, 26 Jan 1976, 2 M, CW 58.5, 59.7 mm, coll. F. Puylaert. GABON.—NNH 24761, Tussen Turindo en Makakou, 1 adult, 7 Mar 1962, coll. B. Condé (donated by J. Gery). SMF 7296, Ivindo u. Mariyots, Makokon, 1 F, CW 66.5 mm, 9 Dec 1975, coll. unknown.

Central African Republic: MNHN B5078, Bangui. NMU 1.IV.1991, river Oubangi, at Bangui, 1 M, 1 F, (found with 1 *Potamonantes langi*), 1 Apr 1991, coll. L. M. Bourgault. RCM 55.400, Landjia river Oubangi, 1 M, 1 F, 3 Feb 1982, coll. L. de Vos & Kempeneers. RCM 56.349, Kembé, above the falls on the river Kotto, 29 Mar 1984, 2 adults, coll. J. P. Marquet. Zaire: NMU VII.1993, Kinshasa, Zaire river, 4 M, 8 Jul 1993, coll. L. M. Bourgault. USNM 54300, Faradje, 1 M, 1 F, 7 Mar 1915. SMF 2382, Lisala, 1 M, CW 48.7 mm, coll. S. Deheyn (RCM 32071). RCM 71, river Ubangi, Banzyville, 1 juv, 1901, coll. G. T. Royaux. RCM 202, Equaterville, 1 F juv, 1921, coll. Verlaine. RCM 258, Leopoldville (= Kinshasa), 1 specimen, 1933, coll. M. A. Cinant. RCM 50.379, Stanley pool (= Kisangani), 1 F, 17 Jul 1957, coll. P. Brien, M. Poll, & J. Bouillion. RCM 50.380, Stanley pool (= Kisangani), 1 M, Apr 1957, coll. P. Brien, M. Poll, & J. Bouillion. RCM 54.043, Stanley pool (= Kisangani), 2 specimens, 1 Mar 1953, coll. J. Mandeville. ZMB 13494, Dumé, 1 F, coll. 29 Jun 1909, O. Freyer.

Diagnosis.—Postfrontal crest spanning entire carapace, crest deeply notched before meeting sharp, forward-pointing epibranchial tooth; shallow notch in crest behind exo-orbital tooth; series of 7 to 8 sharp teeth on anterolateral margin posterior to epibranchial tooth. Posterior lateral surface of carapace with fields of raised short lines; cervical, semi-circular, cardiac, urogastric grooves very deep. Epibranchial, intermediate and exorbital teeth all large, sharp, pointed forward. Terminal segment of gonopod 1 long, thin and needle-like, subterminal segment of gonopod 1 slender. Carapace very flat (CH/CL = 0.41).

Redescription.—Carapace (Fig. 1a–c) ovoid, widest on anterior third (CW/CL 1.36), very flat (CH/CL 0.41), cervical, semi-circular, urogastric, cardiac grooves very deep; transverse branchial grooves present but weak. Front bilobed, indented, anterior margin curving down, relatively

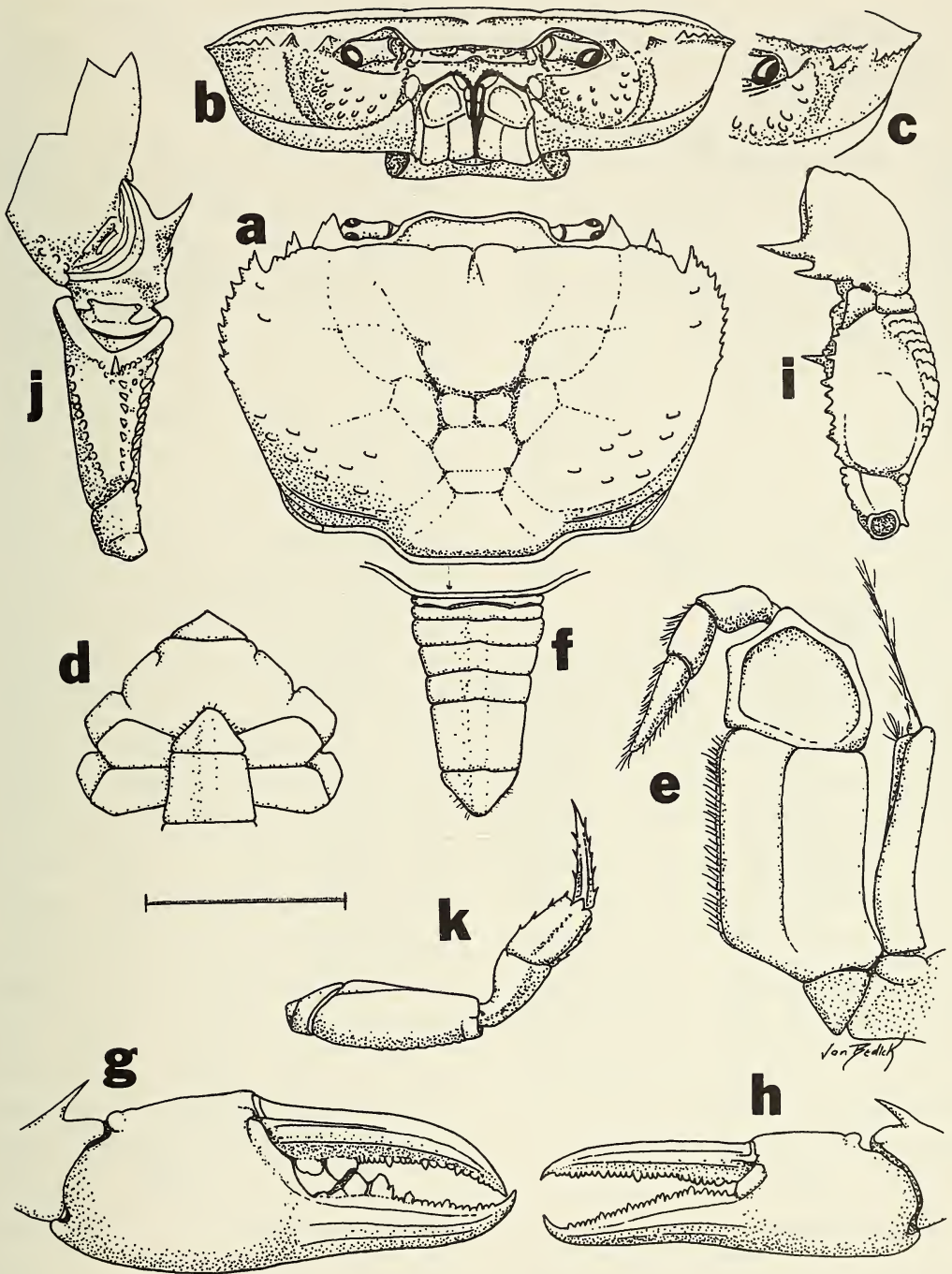


Fig. 1. *Sudanonautes faradjensis* (Rathbun, 1921), adult male holotype, (CW 71.5 mm) from Faradje, Zaire (AMNH 3346). a, whole animal, dorsal aspect; b, carapace, frontal aspect; c, carapace showing detail of epi-branchial corner; d, sternum; e, left third maxilliped; f, abdomen; g, right cheliped, frontal view; h, left cheliped, frontal view; i, carpus, and merus of right cheliped, superior view; j, carpus, and merus of right cheliped, inferior view; k, left pereopod 2. Scale bar equals 30 mm (a, b, c, d, f), 15 mm (g-k), 10 mm (e).

narrow, less than $\frac{1}{3}$ carapace width (FW/CW = 0.30). Posterior lateral surface of carapace with fields of raised short lines, anterolateral surface with faint raised granules. Postfrontal crest spanning entire carapace, consisting of fused epigastric, post-orbital crests, almost straight in epigastric regions, curving forward behind orbits to meet anterolateral margins at the epibranchial teeth; crest smooth in middle, slight crenulations at lateral ends. Postfrontal crest deeply notched before meeting sharp, forward-pointing epibranchial tooth; shallow notches in crest behind exo-orbital tooth and behind front; mid-groove on postfrontal crest short, forked at posterior end. Series of 7 to 8 small sharp teeth on anterolateral margin posterior to epibranchial tooth; anterolateral margin continuous with posterolateral margin. Posterior margin about $\frac{2}{3}$ as wide as carapace width.

Fields of conspicuous granules in sub-orbital regions. Suborbital, subhepatic, and pterygostomial regions with 2 sutures, 1 longitudinal, 1 vertical, dividing area into 3 parts (Fig. 1b, c). Longitudinal suture dividing suborbital, subhepatic regions from pterygostomial region, beginning medially at lower margin of orbit, curving backward across entire region. Vertical suture short, v-shaped, dividing suborbital region from subhepatic region marked by row of small rounded granules (Fig. 1b, c); suture origins between exo-orbital and intermediate teeth, curving down to meet longitudinal suture. Third maxillipeds filling entire oral field, except for transversely oval efferent respiratory openings at superior lateral corners; long, plumose flagellum on exopod of third maxilliped (Fig. 1e); ischium of third maxilliped smooth, with clear vertical groove (Fig. 1e). Mandibular palp 2-segmented; terminal segment single, undivided, fringed with hairs, longest at junction between segments (Fig. 2a-c). First transverse groove on sternum (between sternal segments 2 and 3) complete; second groove (between sternal segments 3 and 4) consisting of 2 small notches at sides of sternum (Fig. 1d).

Segments 1-6 of abdomen four sided, last segment triangular, sides indented, rounded at distal margin (Fig. 1f); segment 3 broadest, segments 4-7 tapering inwards (Fig. 1f).

Gonopod 1 with very slender terminal segment, long ($\frac{4}{5}$ as long as subterminal segment), almost straight continuation of subterminal segment, only gently curved outward, tapering to pointed tip, longitudinal groove visible from caudal and superior views (Fig. 2d, f), not visible from cephalic view (Fig. 2e). Subterminal segment of gonopod 1 very slim (Fig. 2d, e), with raised flap extending halfway across segment, margin vertical, edged with small spines, flap forming roof of chamber for gonopod 2; subterminal segment beneath flap forming lower floor of chamber for gonopod 2 (Fig. 2d). Gonopod 2 (Fig. 2g) shorter than gonopod 1 (reaching only to junction between last 2 segments of gonopod 1). Terminal segment of gonopod 2 extremely short, only $\frac{1}{9}$ as long as subterminal segment, sides folded inwards and spoon-shaped, tip rounded. Subterminal segment gonopod 2 widest at base, tapering sharply inward, forming long, thin, pointed, upright process which supports short terminal segment; rounded collar at junction between terminal segment and subterminal segment.

Chelipeds (Fig. 1g-j) unequal, right longer, higher than left. Dactylus of right cheliped long, slender, grooved, not arched; palm of propodus swollen; proximal region of fingers of digits of right cheliped each with 2 large teeth, opposing teeth meeting, forming small space at base, cut off from the longer interspace distal to these teeth. Both fingers with 3 intermediate sized pointed teeth, interspersed with a series of smaller pointed teeth along their lengths (Fig. 1g, h). Teeth of smaller cheliped all very small, fingers almost meeting when closed. Inferior margins of merus with rows of small teeth, cluster of granules surrounding larger pointed tooth at distal end. Inner margin of carpus of cheliped with 2 large, slender, pointed teeth, second half size of

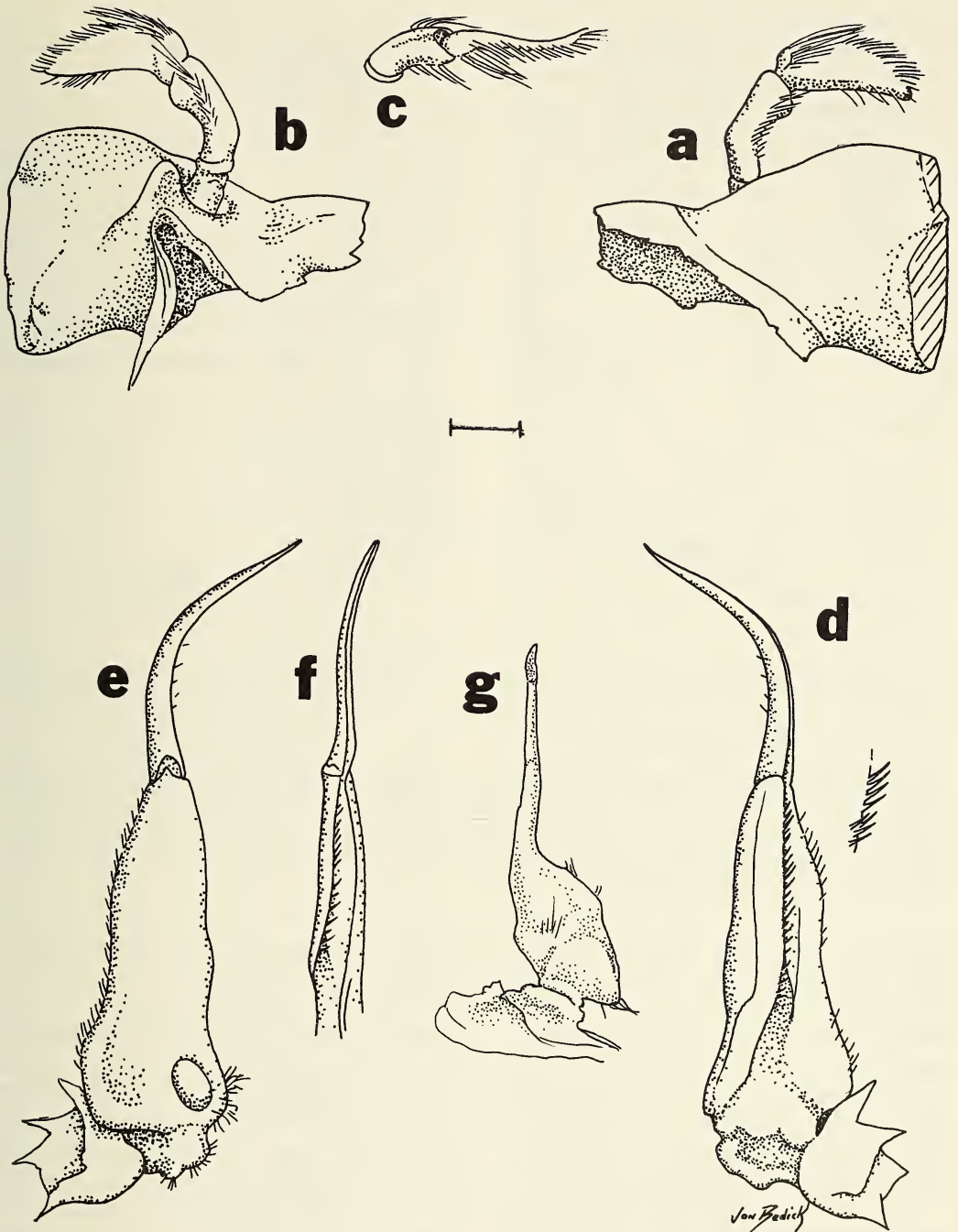


Fig. 2. *Sudanonautes faradjensis* (Rathbun, 1921). a, left mandible anterior view; b, left mandible posterior view; c, left mandibular palp, superior view; d, left gonopod 1, caudal view; e, left gonopod 1, cephalic view; f, terminal segment of left gonopod 1, superior view; g, left gonopod 2, caudal view. Scale bar equals 3 mm (a-c), 2 mm (d-g). (a-f, adult male holotype (CW 71.5 mm) from Faradje, Zaire, AMNH 3346; g, adult male (CW 66 mm) from Kinshasa, Zaire, NMU VII.1993.)

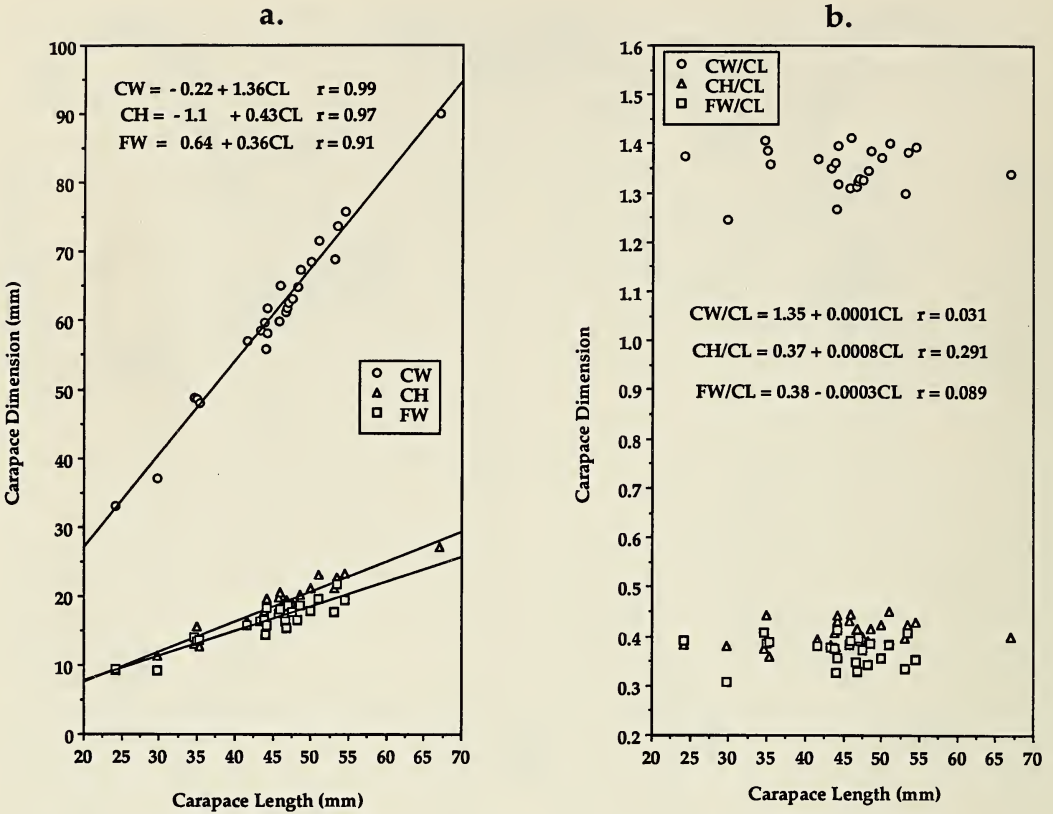


Fig. 3. Comparisons of 24 specimens of *Sudanonautes faradjensis* (Rathbun, 1921). a, dimensions of the carapace (CW, CH, FW) compared to body size (CL), r values (all at $df = 23$) indicate a highly significant correlation ($P < 0.001$) between size classes; b, relative proportions of carapace width (CW/CL), carapace height (CH/CL), and front width (FW/CL), compared to body size (CL), r values (all at $df = 23$) indicate no significant correlation ($P > 0.05$) between size classes.

first (Fig. 1i, j). Left cheliped similar to right, but smaller (Fig. 1h). Walking legs (pereopods 2–5) slender (Fig. 1k), fourth longest, fifth shortest. Posterior margin of propodi serrated, dactyli tapering to point, each bearing rows of downward-pointing sharp bristles; dactylus of fifth shortest of the walking legs. Stridulating apparatus associated with coxae of pereopod 2.

Adult female.—Right and left chelipeds similar proportions to male of similar size, unequal in both length and height. Mature female abdomen very wide, reaching coxae of pereopods 2–5. Segments of female abdomen 4-sided, becoming gradually longer distally, segments 1–5 becoming gradually wider (widest at groove separating seg-

ments 4, 5); segment 6 and telson together forming near semicircle.

Growth (Fig. 3a, b).—Carapace dimensions and relative proportions as shown in Fig. 3a, b. Sexual maturity judged by development of female abdomen: abdomen of mature females overlapping bases of coxae of walking legs, pleopods broad, hair-fringed. Pubertal molt occurring between CW 35–45 mm. Largest known specimen (male from Cameroon) CW 90 mm. Relative width of carapace (in relation to carapace length, CW/CL) not changing with age: CW/CL of adults not significantly wider ($P > 0.05$) than that of juvenile and pubescent animals (Fig. 3b). Width of frontal margin (FW/CL) not changing with age:

FW/CL of adults not significantly wider ($P > 0.05$) than that of juvenile and pubescent animals (Fig. 3b). Relative height of carapace (CH/CL) not changing with age: that of adult *S. faradjensis* not significantly different ($P < 0.05$) than CH/CL of juvenile and pubescent animals. Shape of gonopod 1 and chelipeds changing as crabs grow older. Terminal segment of gonopod 1 of juveniles almost straight; right and left chelipeds of juveniles (CW 25–40 mm) are even sized, palms not inflated, cutting edges meeting, not enclosing a space.

Color.—(Based on living adult from Kinshasa, Zaire). Dorsal carapace and post-frontal crest dark brown-black, flanks paler brown; eyestalk brown, cornea black; sternum, abdomen light brown. Arthro-dial membranes between joints of chelipeds and pereopods light brown; chelipeds, pereopods light brown.

Distribution.—Rain forest regions of Cameroon, Central African Republic, Gabon, Zaire. Middle reaches of the Zaire river basin, and in the rivers Ubangui and Uele, tributaries of the Zaire river. Distribution in Zaire described by Rathbun (1921) and Balss (1936), and in Cameroon by Balss (1929).

Ecological Notes.—*Sudanonautes faradjensis* is restricted to the more humid areas of the rain forest from south Cameroon to Zaire. This species occurs in permanent aquatic habitats from large rivers to small streams. The following notes are based on Herbert Lang's observations (leader of U.S.A. Congo Expedition) as reported by Rathbun (1921). *Sudanonautes faradjensis* is one of the largest river-living crabs of the Uele district in the Zaire basin. The species is found under stones in quiet portions of the river near rapids, where it is reportedly preyed upon by small crocodiles and carnivorous fish. *Sudanonautes faradjensis* moves quickly and can usually escape from its predators.

Remarks.—The short terminal segment of gonopod 2 (Fig. 2g), the long, slender, outward-curving terminal segment of gon-

opod 1 (Fig. 2d), and the intermediate tooth on the anterolateral margin between the exo-orbital and epibranchial teeth (Fig. 1a–c) place this species in *Sudanonautes*. Identification of *S. faradjensis* to species can be made by noting the following characters: a very flat carapace (CH/CL = 0.41) with fields of raised short lines on the posterior lateral surface; large, sharp, forward-pointing epibranchial, intermediate and exorbital teeth; a series of 7 to 8 sharp teeth on the anterolateral margin posterior to the epibranchial tooth; a deep notch on the post-frontal crest before it meets the epibranchial tooth; and a long, thin and needle-like, terminal segment of gonopod 1.

Comparisons.—*Sudanonautes faradjensis* is most likely to be confused with other large species of fresh-water crabs occurring in the rain forest zones of Central Africa, such as *S. chavanesii* (A. Milne Edwards, 1886) and *S. africanus* (A. Milne Edwards, 1869). Since the terminal segment of gonopod 1 of all three species is similar (but not identical), other characters should be used to distinguish between species. For example, *S. faradjensis* can be distinguished from both *S. africanus* and *S. chavanesii* by examination of the anterolateral margin: that of *S. faradjensis* possesses rows of sharp teeth behind the epibranchial tooth (Fig. 1a), whereas the anterolateral margins of *S. africanus* and *S. chavanesii* are both smooth. In addition, the epibranchial tooth of *S. faradjensis* is sharp and pointed (Fig. 1a), whereas that of *S. africanus* is small and low. Furthermore, the epibranchial tooth of *S. faradjensis* is in line with the mid-point of the postfrontal crest (Fig. 1a), whereas that of *S. chavanesii* is set back posteriorly, well behind the line of the mid-point of the postfrontal crest.

In addition to the above differences, there are a number of characters that distinguish *S. faradjensis* from the other species in the genus. For example, the carapace of *S. faradjensis* is significantly flatter ($P < 0.001$) than most other species in the genus, and the carapace of *S. faradjensis* is rough-text-

tured with patches of raised blisters and ridges in the posterior region, and deep urogastric and cardiac grooves (Fig. 1a).

The spiny river crab, *Liberonautes chaperti* (A. Milne Edwards, 1887), redescribed by Cumberlidge (1985) and Cumberlidge & Sachs (1989), is superficially similar to *S. faradjensis*. However, the two species can be easily distinguished by the terminal segment of gonopod 2: that of *L. chaperti* is long, like a flagellum, whereas that of *S. faradjensis* is short and stubby (Fig. 2g). In addition, the terminal segment of gonopod 1 of *L. chaperti* curves inward, not outward as in *S. faradjensis* (Fig. 2d). Finally, *L. chaperti* is found only in West Africa from Côte d'Ivoire to Guinea, whereas *S. faradjensis* is restricted to the forests of Central Africa.

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Literature Cited

- Balss, H. 1929. Potamonidae au Cameroun. *In* Contribution à l'étude de la faune du Cameroun.—Faune des Colonies Françaises 3:115–129.
- . 1936. Beitrage zur Kenntnis der Potamidæ (Süsswasserkrabben) des Kongogebeites.—Revue du Zoologie et Botanie d'Afrique 28:65–204.
- Bott, R. 1955. Die Süsswasserkrabben von Afrika (Crust., Decap.) und ihre Stammesgeschichte.—Annales du Musée Royal du Congo Belge, C-Zoologie Série III, III 1(3):209–352.
- . 1970. Betrachtungen über die Entwicklungsgeschichte und Verbreitung der Süsswasserkrabben nach der Sammlung des Naturhistorischen Museums in Genf/Schweiz.—Revue Suisse de Zoologie 77(2), 24:327–344.
- Capart, A. 1954. Révision des types des espèces de Potamonidae de l'Afrique Tropicale conservés au Muséum d'Histoire Naturelle de Paris.—Volume Jubilaire Victor Van Strallen, Director de l'Institut Royale des Sciences Naturelles de Belgique, 1925–1934 II:819–847.
- Chace, F. A. 1942. Scientific results of a fourth expedition to forested areas in eastern Africa, III: Decapod Crustacea.—Bulletin of the Museum of Comparative Zoology 91:185–233.
- Cumberlidge, N. 1985. Redescription of *Liberonautes chaperti* (A. Milne Edwards, 1887) n. comb., a fresh-water crab from Ivory Coast (Brachyura, Potamonautidae).—Canadian Journal of Zoology 63:2704–2707.
- , & R. Sachs. 1989. A key to the crabs of Liberian freshwaters.—Zeitschrift für Angewandte Zoologie 76:221–229.
- Milne Edwards, A. 1869. Révision du genre *Thelphusa* et description de quelques espèces nouvelles faisant partie de la collection du Muséum.—Nouvelles Archives du Muséum d'Histoire naturelle, Paris 5:161–191.
- . 1886. La description de quelques Crustacés du genre *Thelphusa* recueillis par M. de Brazza dans les régions du Congo.—Bulletin de la Société Philomathique de Paris, Série 7 10:148–151.
- . 1887. Observations sur les crabes des eaux douces de l'Afrique.—Annales des Sciences Naturelles, Zoologie, Paris (7)4:121–149.
- Monod, T. 1977. Sur quelques crustacés Décapodes africaines (Sahel, Soudan).—Bulletin de Muséum national d'Histoire naturelle, Paris 3, 500: 1201–1236.
- Rathbun, M. J. 1921. The Brachyuran Crabs collected by the American Museum Congo expedition 1909–1915.—Bulletin of the American Museum of Natural History 43:379–474.